



Integrated Device Technology, Inc.

## FAST CMOS OCTAL TRANSCEIVER/ REGISTERS (3-STATE)

IDT54/74FCT646T/AT/CT/DT - 2646T/AT/CT  
IDT54/74FCT648T/AT/CT  
IDT54/74FCT652T/AT/CT/DT - 2652T/AT/CT

### FEATURES:

#### • Common features:

- Low input and output leakage  $\leq 1\mu\text{A}$  (max.)
- Extended commercial range of  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$
- CMOS power levels
- True TTL input and output compatibility
  - $V_{OH} = 3.3\text{V}$  (typ.)
  - $V_{OL} = 0.3\text{V}$  (typ.)
- Meets or exceeds JEDEC standard 18 specifications
- Product available in Radiation Tolerant and Radiation Enhanced versions
- Military product compliant to MIL-STD-883, Class B and DESC listed (dual marked)
- Available in DIP, SOIC, SSOP, QSOP, TSSOP, CERPACK and LCC packages

#### • Features for FCT646T/648T/652T:

- Std., A, C and D speed grades
- High drive outputs (-15mA IOH, 64mA IOL)
- Power off disable outputs permit "live insertion"

#### • Features for FCT2646T/2652T:

- Std., A, and C speed grades
- Resistor outputs (-15mA IOH, 12mA IOL Com.)  
(-12mA IOH, 12mA IOL Mil.)
- Reduced system switching noise

### DESCRIPTION:

The FCT646T/FCT2646T/FCT648T/FCT652T/2652T consist of a bus transceiver with 3-state D-type flip-flops and control circuitry arranged for multiplexed transmission of data directly from the data bus or from the internal storage registers.

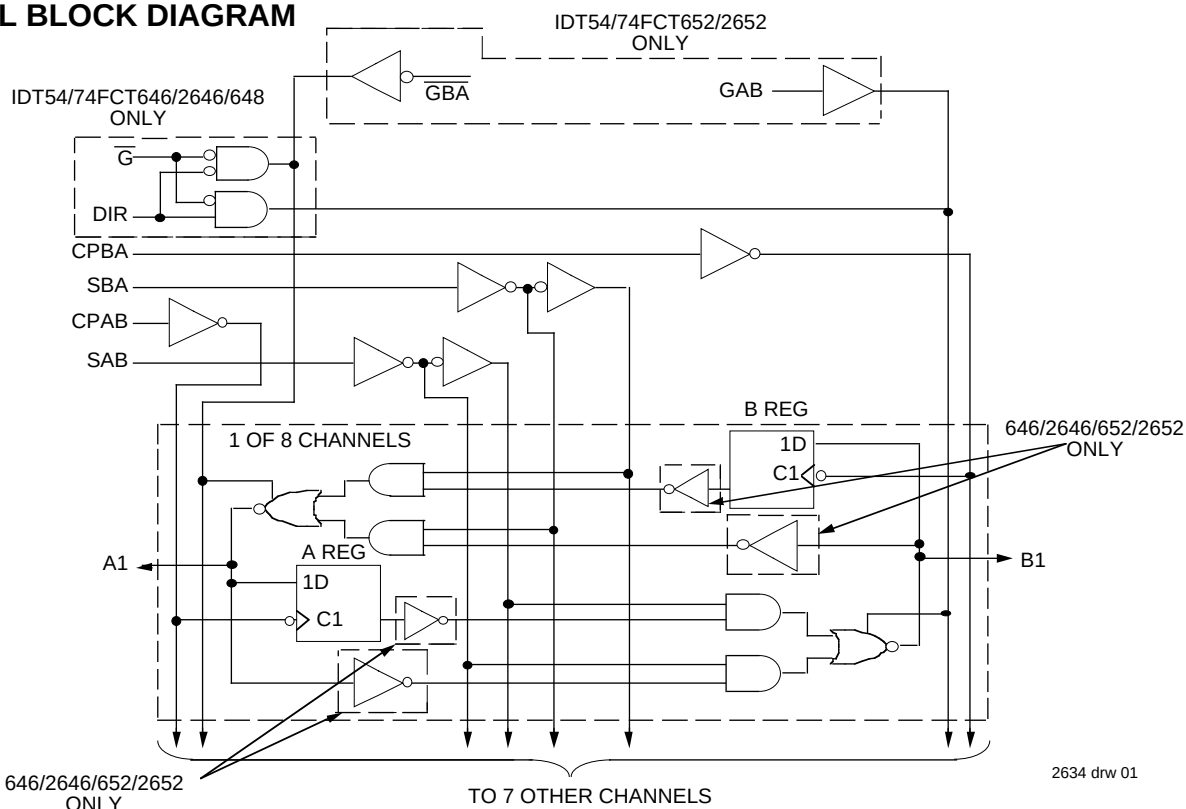
The FCT652T/FCT2652T utilize GAB and  $\overline{\text{GAB}}$  signals to control the transceiver functions. The FCT646T/FCT2646T/FCT648T utilize the enable control ( $\overline{\text{G}}$ ) and direction (DIR) pins to control the transceiver functions.

SAB and SBA control pins are provided to select either real-time or stored data transfer. The circuitry used for select control will eliminate the typical decoding glitch that occurs in a multiplexer during the transition between stored and real-time data. A LOW input level selects real-time data and a HIGH selects stored data.

Data on the A or B data bus, or both, can be stored in the internal D flip-flops by LOW-to-HIGH transitions at the appropriate clock pins (CPAB or CPBA), regardless of the select or enable control pins.

The FCT26xxT have balanced drive outputs with current limiting resistors. This offers low ground bounce, minimal undershoot and controlled output fall times-reducing the need for external series terminating resistors. FCT2xxT parts are plug-in replacements for FCTxxxT parts.

### FUNCTIONAL BLOCK DIAGRAM

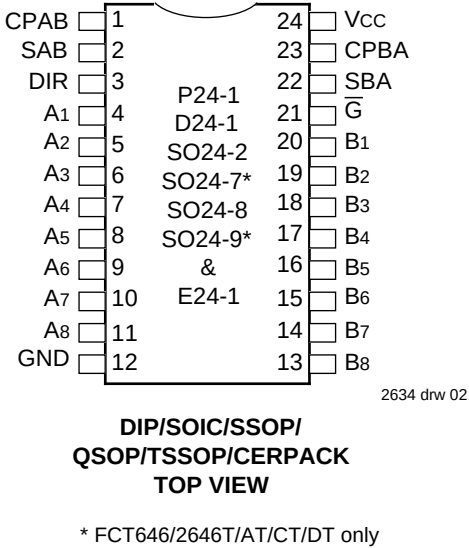


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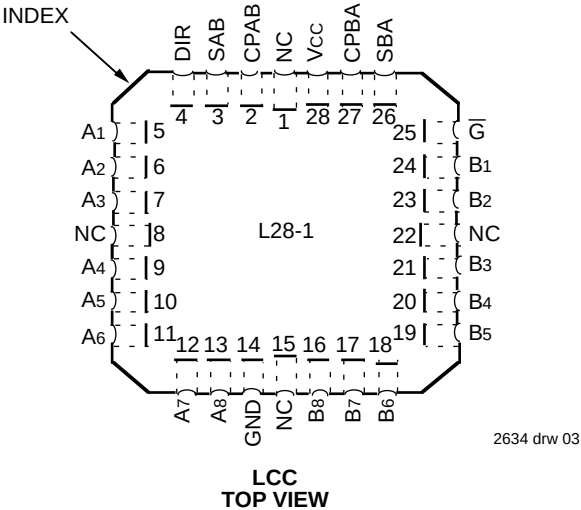
MILITARY AND COMMERCIAL TEMPERATURE RANGES

SEPTEMBER 1996

PIN CONFIGURATIONS

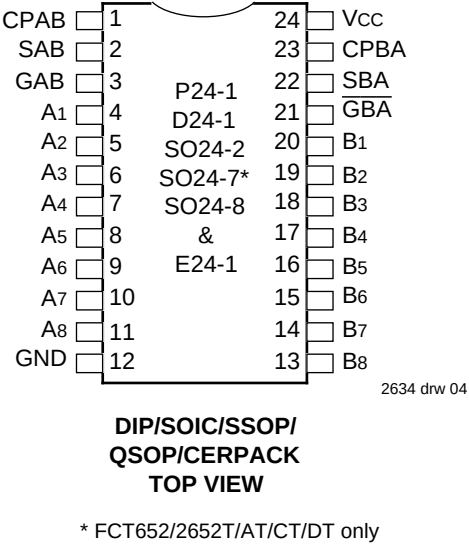


FCT646/FCT2646T  
FCT648

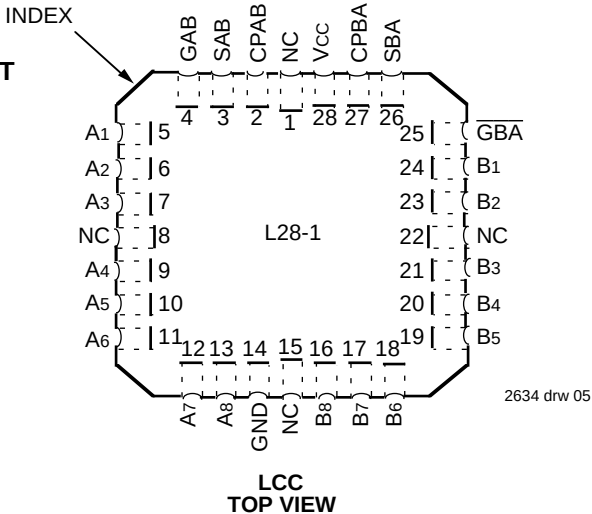


2634 drw 03

LCC  
TOP VIEW



FCT652/FCT2652T



2634 drw 05

LCC  
TOP VIEW

PIN DESCRIPTION

| Pin Names             | Description                                       |
|-----------------------|---------------------------------------------------|
| A1 - A8               | Data Register A Inputs<br>Data Register B Outputs |
| B1 - B8               | Data Register B Inputs<br>Data Register A Outputs |
| CPAB, CPBA            | Clock Pulse Inputs                                |
| SAB, SBA              | Output Data Source Select Inputs                  |
| DIR, $\overline{G}$   | Output Enable Inputs (646/648)                    |
| GAB, $\overline{GBA}$ | Output Enable Inputs (652)                        |

2634 tbl 01

## FUNCTION TABLE (646/648)

| Inputs         |     |        |        |     |     | Data I/O <sup>(1)</sup>         |                                 | Operation or Function     |                                        |
|----------------|-----|--------|--------|-----|-----|---------------------------------|---------------------------------|---------------------------|----------------------------------------|
| $\overline{G}$ | DIR | CPAB   | CPBA   | SAB | SBA | A <sub>1</sub> - A <sub>8</sub> | B <sub>1</sub> - B <sub>8</sub> | FCT646T/FCT2646T          | FCT648T                                |
| H              | X   | H or L | H or L | X   | X   | Input                           | Input                           | Isolation                 | Isolation                              |
| H              | X   | ↑      | ↑      | X   | X   |                                 |                                 | Store A and B Data        | Store A and B Data                     |
| L              | L   | X      | X      | X   | L   | Output                          | Input                           | Real-Time B Data to A Bus | Real-Time $\overline{B}$ Data to A Bus |
| L              | L   | X      | H or L | X   | H   |                                 |                                 | Stored B Data to A Bus    | Stored $\overline{B}$ Data to A Bus    |
| L              | H   | X      | X      | L   | X   | Input                           | Output                          | Real-Time A Data to B Bus | Real-Time $\overline{A}$ Data to B Bus |
| L              | H   | H or L | X      | H   | X   |                                 |                                 | Stored A Data to B Bus    | Stored $\overline{A}$ Data to B Bus    |

2634 tbl 02

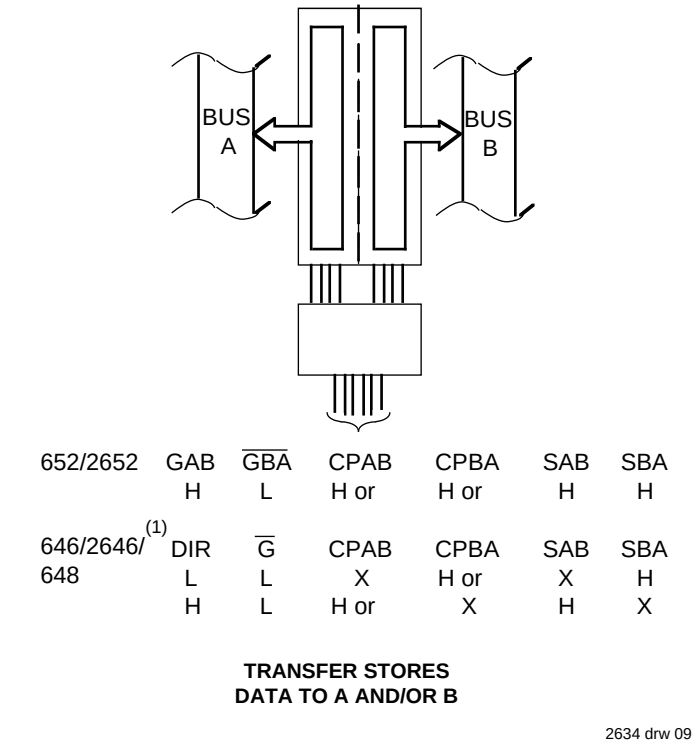
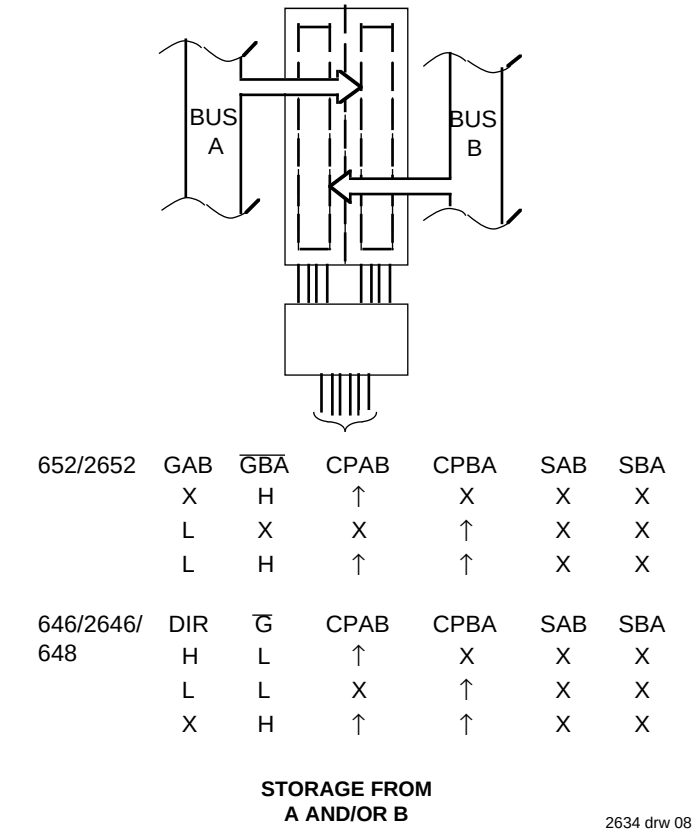
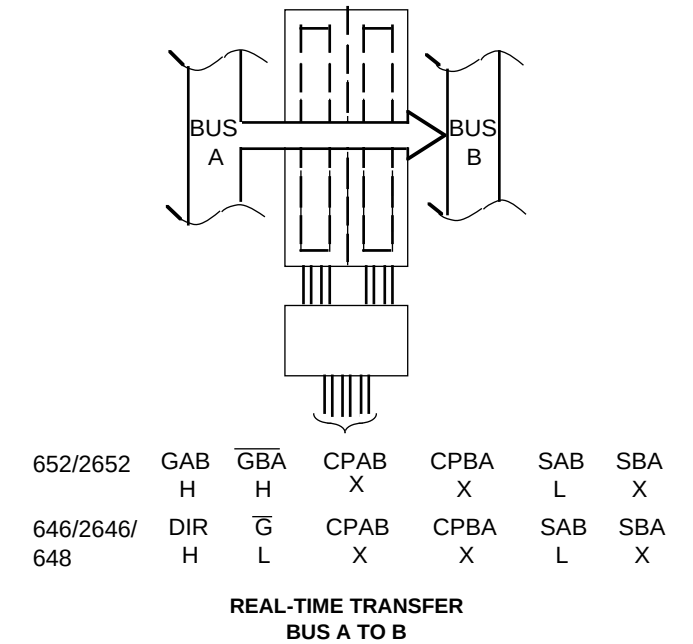
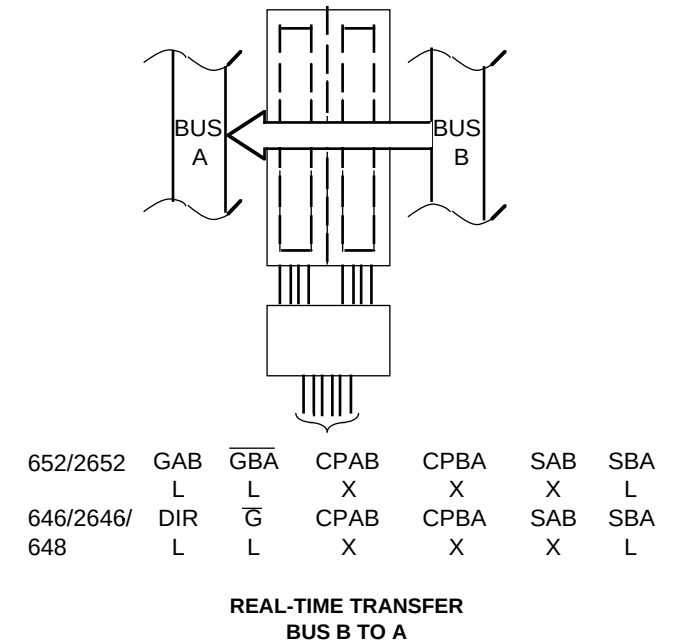
## FUNCTION TABLE (652)

| Inputs |                  |        |        |                  |                  | Data I/O                        |                                 | Operation or Function                             |  |
|--------|------------------|--------|--------|------------------|------------------|---------------------------------|---------------------------------|---------------------------------------------------|--|
| GAB    | $\overline{GBA}$ | CPAB   | CPBA   | SAB              | SBA              | A <sub>1</sub> - A <sub>8</sub> | B <sub>1</sub> - B <sub>8</sub> | FCT652T/FCT2652T                                  |  |
| L      | H                | H or L | H or L | X                | X                | Input                           | Input                           | Isolation                                         |  |
| L      | H                | ↑      | ↑      | X                | X                |                                 |                                 | Store A and B Data                                |  |
| X      | H                | ↑      | H or L | X                | X                | Input                           | Unspecified <sup>(1)</sup>      | Store A, Hold B                                   |  |
| H      | H                | ↑      | ↑      | X <sup>(2)</sup> | X                | Input                           | Output                          | Store A in Both Registers                         |  |
| L      | X                | H or L | ↑      | X                | X                | Unspecified <sup>(1)</sup>      | Input                           | Hold A, Store B                                   |  |
| L      | L                | ↑      | ↑      | X                | X <sup>(2)</sup> | Output                          | Input                           | Store B in Both Registers                         |  |
| L      | L                | X      | X      | X                | L                | Output                          | Input                           | Real-Time B Data to A Bus                         |  |
| L      | L                | X      | H or L | X                | H                |                                 |                                 | Stored B Data to A Bus                            |  |
| H      | H                | X      | X      | L                | X                | Input                           | Output                          | Real-Time A Data to B Bus                         |  |
| H      | H                | H or L | X      | H                | X                |                                 |                                 | Stored A Data to B Bus                            |  |
| H      | L                | H or L | H or L | H                | H                | Output                          | Output                          | Stored A Data to B Bus and Stored B Data to A Bus |  |

### NOTES:

2634 tbl 03

- The data output functions may be enabled or disabled by various signals at the GAB or GBA inputs. Data input functions are always enabled, i.e. data at the bus pins will be stored on every LOW-to-HIGH transition on the clock inputs.
- Select control = L: clocks can occur simultaneously.  
Select control = H: clocks must be staggered in order to load both registers.  
H = HIGH, L = LOW, X = Don't Care, ≠ = LOW-to-HIGH transition.
- $\overline{A}$  in B Register.
- $\overline{B}$  in A Register.



NOTE:

1. 646/2646/648 cannot transfer data to A bus and B bus simultaneously.

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

| Symbol                           | Description                          | Max.                         | Unit |
|----------------------------------|--------------------------------------|------------------------------|------|
| V <sub>TERM</sub> <sup>(2)</sup> | Terminal Voltage with Respect to GND | −0.5 to +7.0                 | V    |
| V <sub>TERM</sub> <sup>(3)</sup> | Terminal Voltage with Respect to GND | −0.5 to V <sub>CC</sub> +0.5 | V    |
| T <sub>STG</sub>                 | Storage Temperature                  | −65 to +150                  | °C   |
| I <sub>OUT</sub>                 | DC Output Current                    | −60 to +120                  | mA   |

### NOTES:

2634 Ink 04

- Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability. No terminal voltage may exceed V<sub>CC</sub> by +0.5V unless otherwise noted.
- Input and V<sub>CC</sub> terminals only.
- Outputs and I/O terminals only.

## CAPACITANCE (T<sub>A</sub> = +25°C, f = 1.0MHz)

| Symbol           | Parameter <sup>(1)</sup> | Conditions            | Typ. | Max. | Unit |
|------------------|--------------------------|-----------------------|------|------|------|
| C <sub>IN</sub>  | Input Capacitance        | V <sub>IN</sub> = 0V  | 6    | 10   | pF   |
| C <sub>OUT</sub> | Output Capacitance       | V <sub>OUT</sub> = 0V | 8    | 12   | pF   |

### NOTE:

2634 Ink 05

- This parameter is measured at characterization but not tested.

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Commercial: T<sub>A</sub> = −40°C to +85°C, V<sub>CC</sub> = 5.0V ± 5%; Military: T<sub>A</sub> = −55°C to +125°C, V<sub>CC</sub> = 5.0V ± 10%

| Symbol           | Parameter                                                          | Test Conditions <sup>(1)</sup>                                   | Min. | Typ. <sup>(2)</sup> | Max. | Unit |
|------------------|--------------------------------------------------------------------|------------------------------------------------------------------|------|---------------------|------|------|
| V <sub>IH</sub>  | Input HIGH Level                                                   | Guaranteed Logic HIGH Level                                      | 2.0  | —                   | —    | V    |
| V <sub>IL</sub>  | Input LOW Level                                                    | Guaranteed Logic LOW Level                                       | —    | —                   | 0.8  | V    |
| I <sub>IH</sub>  | Input HIGH Current <sup>(4)</sup>                                  | V <sub>CC</sub> = Max.<br>V <sub>I</sub> = 2.7V                  | —    | —                   | ±1   | μA   |
| I <sub>IL</sub>  | Input LOW Current <sup>(4)</sup>                                   |                                                                  | —    | —                   | ±1   |      |
| I <sub>OZH</sub> | High Impedance Output Current (3-State Output pins) <sup>(4)</sup> | V <sub>CC</sub> = Max.<br>V <sub>O</sub> = 2.7V                  | —    | —                   | ±1   | μA   |
| I <sub>OZL</sub> |                                                                    |                                                                  | —    | —                   | ±1   |      |
| I <sub>I</sub>   | Input HIGH Current <sup>(4)</sup>                                  | V <sub>CC</sub> = Max., V <sub>I</sub> = V <sub>CC</sub> (Max.)  | —    | —                   | ±1   | μA   |
| V <sub>IK</sub>  | Clamp Diode Voltage                                                | V <sub>CC</sub> = Min., I <sub>IN</sub> = −18mA                  | —    | −0.7                | −1.2 | V    |
| V <sub>H</sub>   | Input Hysteresis                                                   | —                                                                | —    | 200                 | —    | mV   |
| I <sub>CC</sub>  | Quiescent Power Supply Current                                     | V <sub>CC</sub> = Max., V <sub>IN</sub> = GND or V <sub>CC</sub> | —    | 0.01                | 1    | mA   |

2634 Ink 05

## OUTPUT DRIVE CHARACTERISTICS FOR FCT646T/648T/652T

| Symbol           | Parameter                                     | Test Conditions <sup>(1)</sup>                                                 | Min. | Typ. <sup>(2)</sup> | Max. | Unit |
|------------------|-----------------------------------------------|--------------------------------------------------------------------------------|------|---------------------|------|------|
| V <sub>OH</sub>  | Output HIGH Voltage                           | V <sub>CC</sub> = Min.<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> | 2.4  | 3.3                 | —    | V    |
|                  |                                               |                                                                                |      |                     |      |      |
|                  |                                               |                                                                                | 2.0  | 3.0                 | —    | V    |
| V <sub>OL</sub>  | Output LOW Voltage                            | V <sub>CC</sub> = Min.<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> | —    | 0.3                 | 0.55 | V    |
|                  |                                               |                                                                                |      |                     |      |      |
| I <sub>OS</sub>  | Short Circuit Current                         | V <sub>CC</sub> = Max., V <sub>O</sub> = GND <sup>(3)</sup>                    | −60  | −120                | −225 | mA   |
| I <sub>OFF</sub> | Input/Output Power Off Leakage <sup>(5)</sup> | V <sub>CC</sub> = 0V, V <sub>IN</sub> or V <sub>O</sub> ≤ 4.5V                 | —    | —                   | ±1   | μA   |

2634 Ink 06

## OUTPUT DRIVE CHARACTERISTICS FOR FCT2646T/2652T

| Symbol           | Parameter           | Test Conditions <sup>(1)</sup>                                                                                      | Min. | Typ. <sup>(2)</sup> | Max. | Unit |
|------------------|---------------------|---------------------------------------------------------------------------------------------------------------------|------|---------------------|------|------|
| I <sub>ODL</sub> | Output LOW Current  | V <sub>CC</sub> = 5V, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> = 1.5V <sup>(3)</sup> | 16   | 48                  | —    | mA   |
| I <sub>ODH</sub> | Output HIGH Current | V <sub>CC</sub> = 5V, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> = 1.5V <sup>(3)</sup> | −16  | −48                 | —    | mA   |
| V <sub>OH</sub>  | Output HIGH Voltage | V <sub>CC</sub> = Min.<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                      | 2.4  | 3.3                 | —    | V    |
| V <sub>OL</sub>  | Output LOW Voltage  | V <sub>CC</sub> = Min.<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                      | —    | 0.3                 | 0.50 | V    |

### NOTES:

2634 Ink 07

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at V<sub>CC</sub> = 5.0V, +25°C ambient.
- Not more than one output should be shorted at one time. Duration of the short circuit test should not exceed one second.
- The test limit for this parameter is ±5μA at T<sub>A</sub> = −55°C.
- This parameter is guaranteed but not tested.

## POWER SUPPLY CHARACTERISTICS

| Symbol           | Parameter                                         | Test Conditions <sup>(1)</sup>                                                                                                                                                                                                            |                                                            |          | Min. | Typ. <sup>(2)</sup> | Max.                | Unit       |
|------------------|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|----------|------|---------------------|---------------------|------------|
| ΔI <sub>CC</sub> | Quiescent Power Supply Current<br>TTL Inputs HIGH | V <sub>CC</sub> = Max.<br>V <sub>IN</sub> = 3.4V <sup>(3)</sup>                                                                                                                                                                           |                                                            |          | —    | 0.5                 | 2.0                 | mA         |
| I <sub>CCD</sub> | Dynamic Power Supply Current <sup>(4)</sup>       | V <sub>CC</sub> = Max.<br>Outputs Open<br>GAB = $\overline{\text{GBA}}$ = GND or<br>$\overline{\text{G}}$ = DIR = GND<br>One Input Toggling<br>50% Duty Cycle                                                                             | V <sub>IN</sub> = V <sub>CC</sub><br>V <sub>IN</sub> = GND | FCTxxxT  | —    | 0.15                | 0.25                | mA/<br>MHz |
|                  |                                                   |                                                                                                                                                                                                                                           |                                                            | FCT2xxxT | —    | 0.06                | 0.12                |            |
| I <sub>C</sub>   | Total Power Supply Current <sup>(6)</sup>         | V <sub>CC</sub> = Max.<br>Outputs Open<br>f <sub>CP</sub> = 10MHz<br>50% Duty Cycle<br>GAB = $\overline{\text{GBA}}$ = GND or<br>$\overline{\text{G}}$ = DIR = GND<br>One Bit Toggling<br>at f <sub>i</sub> = 5MHz<br>50% Duty Cycle      | V <sub>IN</sub> = V <sub>CC</sub><br>V <sub>IN</sub> = GND | FCTxxxT  | —    | 1.5                 | 3.5                 | mA         |
|                  |                                                   |                                                                                                                                                                                                                                           |                                                            | FCT2xxxT | —    | 0.6                 | 2.2                 |            |
|                  |                                                   | V <sub>CC</sub> = Max.<br>Outputs Open<br>f <sub>CP</sub> = 10MHz<br>50% Duty Cycle<br>GAB = $\overline{\text{GBA}}$ = GND or<br>$\overline{\text{G}}$ = DIR = GND<br>One Bit Toggling<br>at f <sub>i</sub> = 5MHz<br>50% Duty Cycle      | V <sub>IN</sub> = 3.4<br>V <sub>IN</sub> = GND             | FCTxxxT  | —    | 2.0                 | 5.5                 |            |
|                  |                                                   |                                                                                                                                                                                                                                           |                                                            | FCT2xxxT |      | 1.1                 | 4.2                 |            |
|                  |                                                   | V <sub>CC</sub> = Max.<br>Outputs Open<br>f <sub>CP</sub> = 10MHz<br>50% Duty Cycle<br>GAB = $\overline{\text{GBA}}$ = GND or<br>$\overline{\text{G}}$ = DIR = GND<br>Eight Bits Toggling<br>at f <sub>i</sub> = 2.5MHz<br>50% Duty Cycle | V <sub>IN</sub> = V <sub>CC</sub><br>V <sub>IN</sub> = GND | FCTxxxT  | —    | 3.8                 | 7.3 <sup>(5)</sup>  |            |
|                  |                                                   |                                                                                                                                                                                                                                           |                                                            | FCT2xxxT | —    | 1.5                 | 4.0 <sup>(5)</sup>  |            |
|                  |                                                   |                                                                                                                                                                                                                                           | V <sub>IN</sub> = 3.4<br>V <sub>IN</sub> = GND             | FCTxxxT  | —    | 6.0                 | 16.3 <sup>(5)</sup> |            |
|                  |                                                   |                                                                                                                                                                                                                                           |                                                            | FCT2xxxT | —    | 3.8                 | 13.0 <sup>(5)</sup> |            |

### NOTES:

2634 tbl 08

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at V<sub>CC</sub> = 5.0V, +25°C ambient.
- Per TTL driven input (V<sub>IN</sub> = 3.4V). All other inputs at V<sub>CC</sub> or GND.
- This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
- Values for these conditions are examples of the I<sub>CC</sub> formula. These limits are guaranteed but not tested.
- I<sub>C</sub> = I<sub>QUIESCENT</sub> + I<sub>INPUTS</sub> + I<sub>DYNAMIC</sub>  
I<sub>C</sub> = I<sub>CC</sub> + ΔI<sub>CC</sub> D<sub>HT</sub> + I<sub>CCD</sub> (f<sub>CP</sub>/2 + f<sub>i</sub>N<sub>i</sub>)  
I<sub>CC</sub> = Quiescent Current  
ΔI<sub>CC</sub> = Power Supply Current for a TTL High Input (V<sub>IN</sub> = 3.4V)  
D<sub>H</sub> = Duty Cycle for TTL Inputs High  
N<sub>T</sub> = Number of TTL Inputs at D<sub>H</sub>  
I<sub>CCD</sub> = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)  
f<sub>CP</sub> = Clock Frequency for Register Devices (Zero for Non-Register Devices)  
f<sub>i</sub> = Input Frequency  
N<sub>i</sub> = Number of Inputs at f<sub>i</sub>  
All currents are in milliamps and all frequencies are in megahertz.

# SWITCHING CHARACTERISTICS OVER OPERATING RANGE

| Symbol       | Parameter                                                          | Condition <sup>(1)</sup> | 646/648/652T<br>2646/2652T |      |                     |      | 646/648/652AT<br>2646/2652AT |      |                     |      | Unit |
|--------------|--------------------------------------------------------------------|--------------------------|----------------------------|------|---------------------|------|------------------------------|------|---------------------|------|------|
|              |                                                                    |                          | Com'l.                     |      | Mil.                |      | Com'l.                       |      | Mil.                |      |      |
|              |                                                                    |                          | Min. <sup>(2)</sup>        | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup>          | Max. | Min. <sup>(2)</sup> | Max. |      |
| tPLH<br>tPHL | Propagation Delay<br>Bus to Bus                                    | CL = 50pF<br>RL = 500Ω   | 2.0                        | 9.0  | 2.0                 | 11.0 | 2.0                          | 6.3  | 2.0                 | 7.7  | ns   |
| tpZH<br>tpZL | Output Enable Time, $\overline{G}$ ,<br>DIR to Bus <sup>(3)</sup>  |                          | 2.0                        | 14.0 | 2.0                 | 15.0 | 2.0                          | 9.8  | 2.0                 | 10.5 | ns   |
| tpHZ<br>tPLZ | Output Disable Time, $\overline{G}$ ,<br>DIR to Bus <sup>(3)</sup> |                          | 2.0                        | 9.0  | 2.0                 | 11.0 | 2.0                          | 6.3  | 2.0                 | 7.7  | ns   |
| tPLH<br>tPHL | Propagation Delay<br>Clock to Bus                                  |                          | 2.0                        | 9.0  | 2.0                 | 10.0 | 2.0                          | 6.3  | 2.0                 | 7.0  | ns   |
| tPLH<br>tPHL | Propagation Delay SBA or<br>SAB to Bus                             |                          | 2.0                        | 11.0 | 2.0                 | 12.0 | 2.0                          | 7.7  | 2.0                 | 8.4  | ns   |
| tsu          | Set-up Time HIGH or LOW<br>Bus to Clock                            |                          | 4.0                        | —    | 4.5                 | —    | 2.0                          | —    | 2.0                 | —    | ns   |
| th           | Hold Time HIGH or LOW<br>Bus to Clock                              |                          | 2.0                        | —    | 2.0                 | —    | 1.5                          | —    | 1.5                 | —    | ns   |
| tw           | Clock Pulse Width,<br>HIGH or LOW                                  |                          | 6.0                        | —    | 6.0                 | —    | 5.0                          | —    | 5.0                 | —    | ns   |

2634 tbl 09

| Symbol       | Parameter                                                          | Condition <sup>(1)</sup> | 646/648/652CT<br>2646/2652CT |      |                     |      | 646/652DT           |      |                     |      | Unit |
|--------------|--------------------------------------------------------------------|--------------------------|------------------------------|------|---------------------|------|---------------------|------|---------------------|------|------|
|              |                                                                    |                          | Com'l.                       |      | Mil.                |      | Com'l.              |      | Mil.                |      |      |
|              |                                                                    |                          | Min. <sup>(2)</sup>          | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. |      |
| tPLH<br>tPHL | Propagation Delay<br>Bus to Bus                                    | CL = 50pF<br>RL = 500Ω   | 1.5                          | 5.4  | 1.5                 | 6.0  | 1.5                 | 4.4  | —                   | —    | ns   |
| tpZH<br>tpZL | Output Enable Time, $\overline{G}$ ,<br>DIR to Bus <sup>(3)</sup>  |                          | 1.5                          | 7.8  | 1.5                 | 8.9  | 1.5                 | 5.0  | —                   | —    | ns   |
| tpHZ<br>tPLZ | Output Disable Time, $\overline{G}$ ,<br>DIR to Bus <sup>(3)</sup> |                          | 1.5                          | 6.3  | 1.5                 | 7.7  | 1.5                 | 4.3  | —                   | —    | ns   |
| tPLH<br>tPHL | Propagation Delay<br>Clock to Bus                                  |                          | 1.5                          | 5.7  | 1.5                 | 6.3  | 1.5                 | 4.4  | —                   | —    | ns   |
| tPLH<br>tPHL | Propagation Delay SBA or<br>SAB to Bus                             |                          | 1.5                          | 6.2  | 1.5                 | 7.0  | 1.5                 | 5.0  | —                   | —    | ns   |
| tsu          | Set-up Time HIGH or LOW<br>Bus to Clock                            |                          | 2.0                          | —    | 2.0                 | —    | 1.5                 | —    | —                   | —    | ns   |
| th           | Hold Time HIGH or LOW<br>Bus to Clock                              |                          | 1.5                          | —    | 1.5                 | —    | 1.0                 | —    | —                   | —    | ns   |
| tw           | Clock Pulse Width,<br>HIGH or LOW <sup>(4)</sup>                   |                          | 5.0                          | —    | 5.0                 | —    | 3.0                 | —    | —                   | —    | ns   |

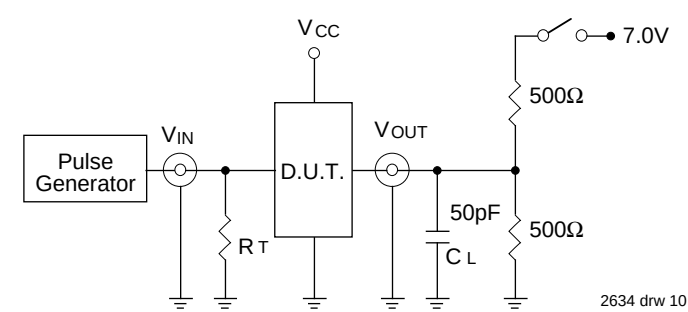
## NOTES:

- See test circuit and waveforms.
- Minimum limits are guaranteed but not tested on Propagation Delays.
- GAB,  $\overline{G}$ BA to Bus for 652.
- This parameter is guaranteed but not tested.

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TEST CIRCUITS AND WAVEFORMS

TEST CIRCUITS FOR ALL OUTPUTS

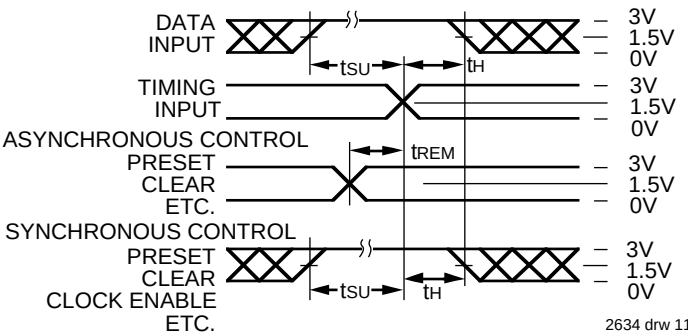


SWITCH POSITION

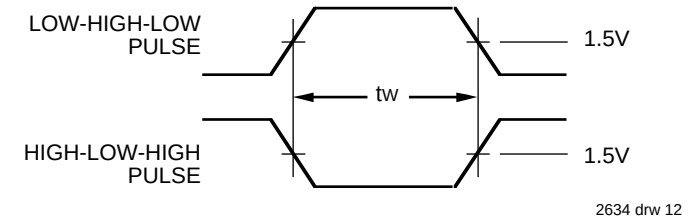
| Test                                    | Switch |
|-----------------------------------------|--------|
| Open Drain<br>Disable Low<br>Enable Low | Closed |
| All Other Tests                         | Open   |

DEFINITIONS: 2634 lmk 11  
CL= Load capacitance: includes jig and probe capacitance.  
RT= Termination resistance: should be equal to ZOUT of the Pulse Generator.

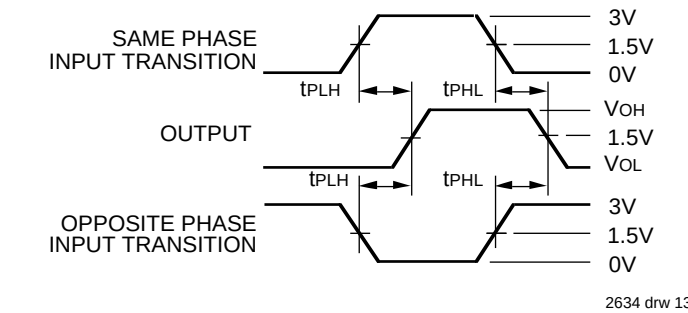
SET-UP, HOLD AND RELEASE TIMES



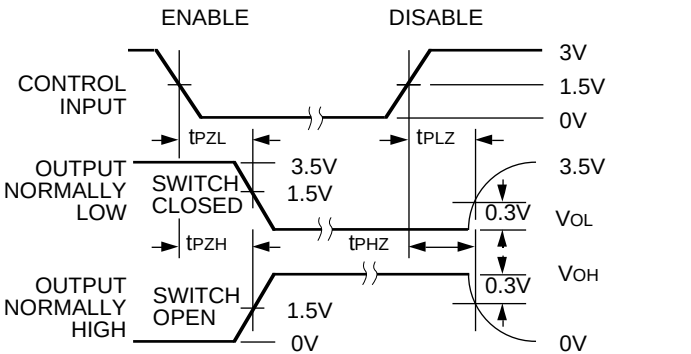
PULSE WIDTH



PROPAGATION DELAY



ENABLE AND DISABLE TIMES



- NOTES:
- Diagram shown for input Control Enable-LOW and input Control Disable-HIGH
  - Pulse Generator for All Pulses: Rate ≤ 1.0MHz; tr ≤ 2.5ns; tr ≤ 2.5ns

ORDERING INFORMATION

| IDT | XX<br>Temperature<br>Range | FCT | X<br>Family | XXXX<br>Device Type | X<br>Package | X<br>Process/<br>Temperature<br>Range |                                             |
|-----|----------------------------|-----|-------------|---------------------|--------------|---------------------------------------|---------------------------------------------|
|     |                            |     |             |                     |              | Blank                                 | Commercial                                  |
|     |                            |     |             |                     |              | B                                     | MIL-STD-883, Class B                        |
|     |                            |     |             |                     |              | P                                     | Plastic DIP (P24-1)                         |
|     |                            |     |             |                     |              | D                                     | CERDIP (D24-1)                              |
|     |                            |     |             |                     |              | SO                                    | Small Outline IC (SO24-2)                   |
|     |                            |     |             |                     |              | L                                     | Leadless Chip Carrier (L28-1)               |
|     |                            |     |             |                     |              | E                                     | CERPACK (E24-1)                             |
|     |                            |     |             |                     |              | PY                                    | Shrink Small Outline Package (SO24-7)       |
|     |                            |     |             |                     |              | Q                                     | Quarter-size Small Outline Package (SO24-8) |
|     |                            |     |             |                     |              | PG                                    | Thin Shrink Small Outline Package (SO24-9)  |
|     |                            |     |             |                     |              | 646T                                  | Non-inverting Octal Transceiver/Register    |
|     |                            |     |             |                     |              | 648T                                  | Inverting Octal Transceiver/Register        |
|     |                            |     |             |                     |              | 652T                                  | Inverting Octal Transceiver/Register        |
|     |                            |     |             |                     |              | 646AT                                 | Non-inverting Octal Transceiver/Register    |
|     |                            |     |             |                     |              | 648AT                                 |                                             |
|     |                            |     |             |                     |              | 652AT                                 |                                             |
|     |                            |     |             |                     |              | 646CT                                 |                                             |
|     |                            |     |             |                     |              | 648CT                                 |                                             |
|     |                            |     |             |                     |              | 652CT                                 |                                             |
|     |                            |     |             |                     |              | 646DT                                 |                                             |
|     |                            |     |             |                     |              | 652DT                                 |                                             |
|     |                            |     |             |                     |              | Blank                                 | High Drive                                  |
|     |                            |     |             |                     |              | 2                                     | Balanced Drive                              |
|     |                            |     |             |                     |              | 54                                    | −55°C to +125°C                             |
|     |                            |     |             |                     |              | 74                                    | −40°C to +85°C                              |

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